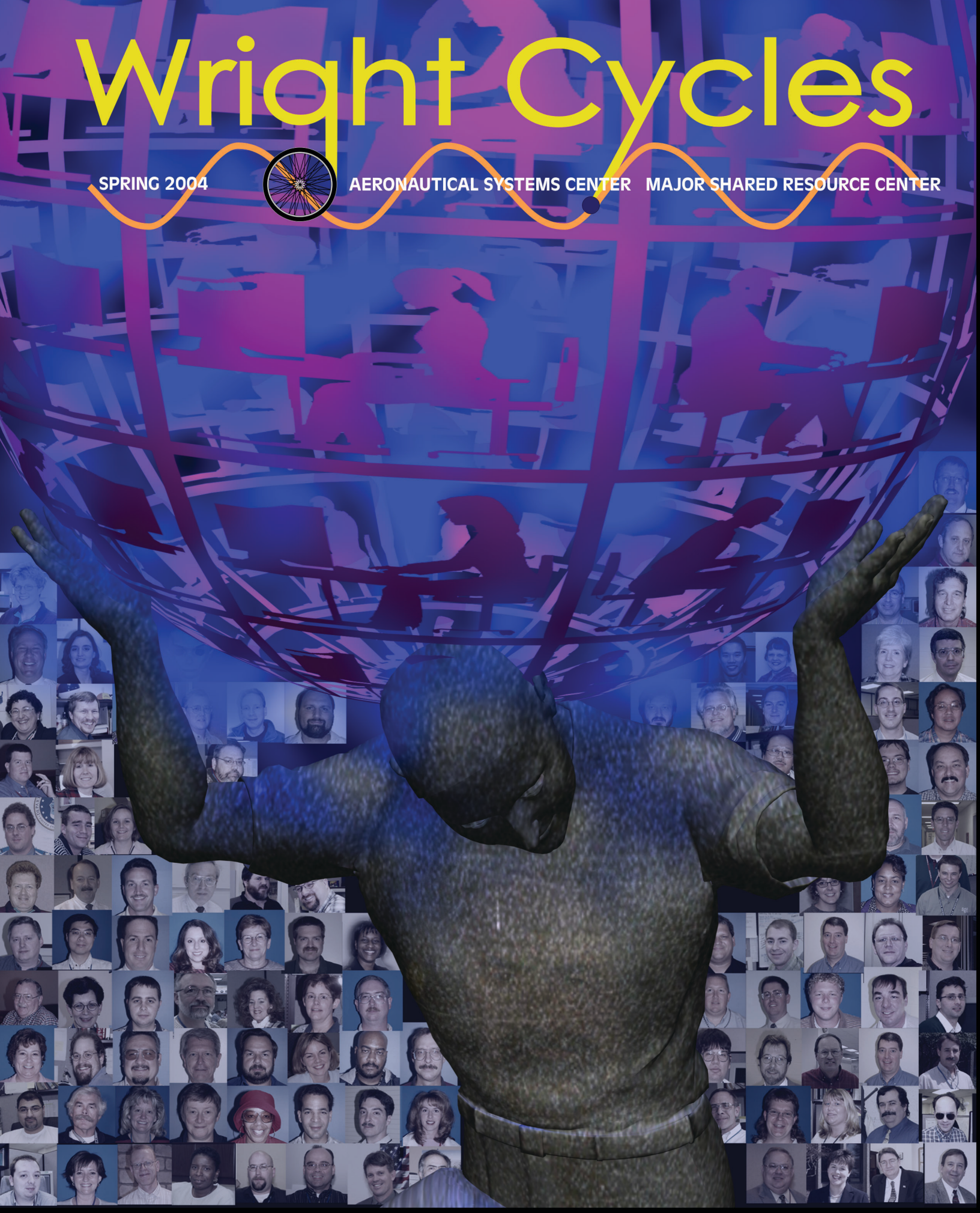
Wright Cycles

SPRING 2004 AERONAUTICAL SYSTEMS CENTER MAJOR SHARED RESOURCE CENTER



A journal highlighting innovations in high performance computing

The HP Director's Desk

David Rothery, SES

The Advanced Computational Analysis Directorate, ASC/HP, Wright-Patterson Air Force Base, welcomes you to the Spring edition of *Wright Cycles*. Our Directorate, which combines unique HPC capabilities at the ASC MSRC, and advanced engineering, modeling, simulation and analysis (MS&A) in the Simulation & Analysis Facility (SIMAF), provides a strong center for all aspects of computational science and engineering in the DoD.

This issue of the Journal (in its 7th year of publication) focuses on the significant strides we have made at the ASC MSRC in various aspects of user support. We would like to draw your attention to the many outstanding highlights, including the examples in the feature article on the "10 best kept secrets..." (by Mr. Jay Blair), software management enhancements, SMART changes, expanded customer assistance, and an overall summary by Mr. Steve Wourms, ASC MSRC Director, recognizing "unsung heroes." We are also continuing to emphasize collaborations of our PET team with computational scientists and engineers throughout the DoD, in diverse areas ranging from forces modeling and simulation to scientific visualization. Furthermore, in our quest to bridge the gap between computational scientists in the S&T and the T&E communities, a success story of fruitful interactions and computer time provided to Lockheed Martin, to reduce testing and cost in support of the Joint Strike Fighter (JSF) program, has emerged.

Indeed, the 21st century battlefield has dramatically changed - "***drive change or be driven by it***." We note that the research, development, testing, and engineering communities address joint collaborations between the Army, Navy, Air Force, and Marines, in new planning initiatives using MS&A. Multifaceted planning, to integrate system of systems, command, control, and communication, together with architecture, system engineering, and forces modeling and simulations, to produce desired results, is fraught with difficulties, including misunderstanding of the problem domain, false assumptions, no accurate estimation of the probabilities, reliance on expectations, complexity in measuring the utility function, and forecasting errors. MS&A, utilizing, in part, HPC, can minimize these and other risks, by assessing different perspectives with potentially unlimited battle space entities. For example, joint SIMAF and ASC MSRC resources facilitated Simulation Based Acquisition (SBA) for the F-35. Note that SIMAF is currently certifying at a Capability Maturity Model Integration (CMMI) Level 2 for Software Development.

It is my pleasure to commend the Outreach team for a tremendous job of enabling us to demonstrate our unique capabilities and share our vision with recent visitors, ranging from local high school students, to numerous users and computational scientists including Dr. Alan Garscadden, Chief Scientist, AFRL/PR; Mr. Les McFawn, Executive Director and Dr. Tom Cruse, Chief Technologist, AFRL; System Program Office (SPO) Directors; and the ASC Commander, Gen William Looney.

Finally, I would like to re-emphasize that the Advanced Computational Analysis Directorate is constantly enhancing the quality of services for all of our customers and users, highlighting the ASC MSRC in this journal. Our pledge is to develop and provide leading edge warfighting tools for "Speeding the Development of Combat Capability for the Second Century of Flight." Overall, we are bringing people, processes, and performance together in ASC/HP to enable a "world class" organization and ensure military advantage and warfighting superiority on the 21st century battlefield—forward to the future!

The Aeronautical Systems Center (ASC) Major Shared Resource Center (MSRC) is a computational science facility supporting Department of Defense (DoD) research, development, and test and evaluation communities with high performance computing and visualization resources. Created as part of the DoD's High Performance Computing Modernization Program (HPCMP), the ASC MSRC High Performance Computing Center is located on Wright-Patterson Air Force Base (WPAFB) and is one of four DoD MSRC sites. Computer Sciences Corporation (CSC) is the prime support contractor at the ASC MSRC.

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About the cover: This issue focuses on user support at the ASC MSRC. The Atlas figure is poised bearing the weight of a sphere containing silhouettes representing our users, which numbers near a thousand. In the background are the images of the 100+ people who provide technical expertise and support to the ASC MSRC. The articles within this issue of *Wright Cycle*s highlight some of the tools and people that make this Center unique within the DoD. We take pride in our efforts in managing the immense and very complex task of bringing high performance computing to the desktop of our users.

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Top Ten Best Kept Secrets of the ASC MSRC

By Jay Blair, CSC

At the ASC MSRC all users go through the same process to perform their research. As a new user, you get your account, SecurID card, and allocation. You then log on to a machine and submit scripts that gets your work completed as productively as you can. It's a piece of cake right? What else could there possibly be to it?

Do you ever wonder what kinds of things go on behind the scenes at a Major Shared Resource Center? You know the backstage, special all-access pass kind of things? You must find it hard to believe that anything exciting happens here especially when your only contact with the ASC MSRC is through email or a phone call with one of our friendly Service Center staff.

Well buckle in and return your seats and trays to their locked, upright position. You are about to find out what makes the ASC MSRC the number one destination of users of HPC resources. You have been granted access to the "Top Ten Best Kept Secrets of the ASC MSRC."

Job Watchdog
The ASC MSRC has a new set of eyes watching out for users who might need some extra help. The Job Watchdog is an application that continuously monitors batch job data in real-time to determine if any one user has had more than a few recent jobs that ran for an unusually short time.

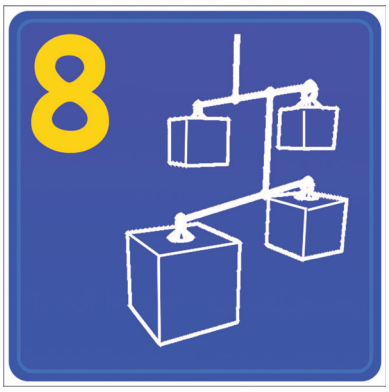
For example, if a user has submitted 10 jobs in the past hour and all of them ran for one minute or less, Watchdog will notice this and alert the ASC MSRC Service Center. The Service Center staff can then take a look at that user's jobs and see if there is an obvious problem with the submit script or something else they can help to resolve.

So, the next time you have job after job die unexpectedly and you are scratching your head trying to figure it out, don't be too surprised if the Service Center mysteriously calls you with the solution to your problem before you even ask. The Job Watchdog just might be your new best friend.

UserPing
One of the biggest complaints that the ASC MSRC hears regards connectivity between users' desk side machines and our big iron. UserPing is a set of scripts that checks connection rates between the ASC MSRC and users in order to detect and diagnose problems and trends before they are noticed as lost connections and long waits between keystrokes.

UserPing is comprised of two types of scripts: a client and a server. The client script resides on a user's computer. After a brief configuration, the client script runs every half-hour, and sends packets from the user's computer to system(s) at the ASC MSRC using the secure shell (ssh) port. The resulting data, such as round-trip time and the percentage of packets that returned, is then collected; logged; analyzed by comparison to a set of user-defined thresholds; and sent via email to the server script.

The server script resides on a computer at the ASC MSRC. Upon receipt of an email from a client script, the server script again logs the data, and then decides if the new results constitute a change in the ability of the user to connect to the ASC MSRC. Any change in status, positive or negative, as well as a prolonged lack of email, causes the script to notify the ASC MSRC Service Center. It's a little like ET phoning home to say the connection is really good from here.

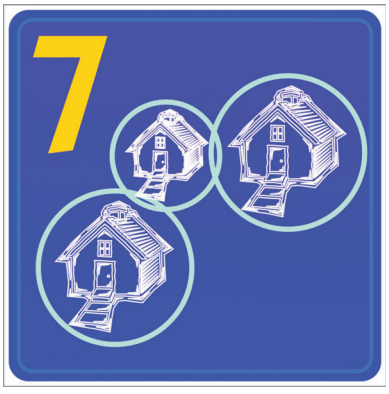


Enhanced Versions of LSF Commands

Your Load Sharing Facility (LSF) script is a work of art. You submit the job and BAM! You are suddenly blessed by an error message. The strange thing is that it seems your job, which previously had an error, has been corrected automagically and is now running. Your saving grace was our LSF esub.

An esub, short for external submission, is an admin-written executable (binary or script) that is used to validate, modify, or reject jobs. LSF checks for its existence when a job is submitted, restarted, and modified. If LSF finds an esub, it runs a check of the job submittal script. Whether the job is submitted, modified, or rejected depends on the information contained within the job submittal script.

ASC's esub currently checks for account number, number of CPUs, wall clock time, amount of memory, requested queue, and whether or not the job is restartable. Additionally, esub checks to see if the user has enough allocation to run the job. In all cases if an error is found, the esub will attempt to fill in the missing or incorrect message. It then reports back to the user what the problem was and provides the contact info for the Service Center. Just remember that a "script" in time saves nine.



NFS Mounts in the Environment

The ASC MSRC has several components that you would expect to find in a computer resource center of this size; an archive and a high availability file server (HAFS). Something rather nice about our Center is that we mount both of these facilities via a network file system (NFS) and set environment variables to their mount points. All of the user home accounts and software are installed in the HAFS. Therefore all software and all home directories follow the user, independent of which machine they log into.

The command "cd $ARC" will take a user to their archive space on the mass storage device. The NFS mount also allows a user to access files in the archive via simple commands such as cp, mv, rcp and scp. The environment variable $HOME references a user's home directory regardless of which of ASC MSRC's machines they run on. Think of it as your own personal shortcut to where you want to go today.

MPSCP

Now you have done it. You ran that large analysis and got great results but you also got a lot of them. Terabytes of data to be specific. You calculate the transfer rate between our machines and your local workstation and find that by the time you retire you will have transferred about half of your data.

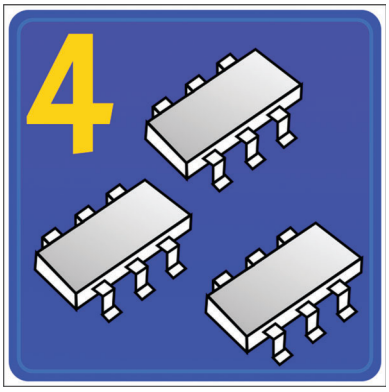
Partnering with the Department of Energy's Sandia National Laboratory, the ASC MSRC is using a new, experimental file transfer protocol to achieve greater data throughput. This protocol allows for large files to be moved over the Defense Research and Engineering Network (DREN) faster by using more of the wide area network bandwidth than a typical file transfer protocol (FTP) or scp transfer. The new protocol, called mpscp (multiple-path secure copy), uses multiple transmission control protocol (TCP) streams (and multiple network interface cards, if available) to segment a large file into pieces and send the pieces in parallel, reassembling them into a single file on the remote side.

The mpscp application has been compiled and tested at the ASC MSRC on the IBM Power3 (hpc04), SGI Origin 3900 (hpc11), Compaq SC-40 (hpc05) and SC-45 (hpc09/10), the SGI Onyx2 and Onyx3 (svw10 and svw11), SGI O2 workstations, Sun Solaris, and Linux (kernel 2.4.20, Intel processor) workstations. mpscp must be available on both the local machine

and the remote machine. The remote machine must allow a ssh connection from the local machine. Now you can spend the next 10 to 20 years relaxing while you look forward to that retirement.

Software
When you get ready to embark on your adventure on the ASC MSRC for the first time you make a list of all of the required supplies: account, SecurID, ssh, Kerberos, compiler, debugger. Wait a minute; do you really expect to do all of your work with just a compiler and a debugger? Well, maybe Mr. Spock could code his way out of a paper bag but for the rest of you who would rather have help we have software, and lots of it.

ASC MSRC has over 70 commercial off-the-shelf (COTS) software packages. The list reads like a Who's Who of industry leaders: Accelrys, Abaqus, ANSYS, Cobalt, Fluent, Gaussian, GAMESS, LS-Dyna, StarCD, VASP and a host of others. In addition we also have many open source standbys such as GIMP, GTK, Emacs, Expect, LAPACK, NCAR Graphics, Perl, Python, ScaLAPACK and most things GNU. A complete list of all software available for use at the ASC MSRC can be found at *http://www.asc.hpc.mil/consolidated/softwareASC_ALL.php*. So if you are not brushed up on your Pascal or your Fortran then feel free to use our COTS or open source codes.



Debugging
One of the greats in the area of computational science was Dr. Grace Brewster Murray Hopper. She literally found the first computer bug, a moth, in an electrical circuit of the Mark II Aiken Relay computer in 1945 at Harvard.

At the ASC MSRC we have our own de-bug-gers. Our code assist group is able to handle FORTRAN, C, C++ and shell scripting questions. Whether your code is on a PC or UNIX machine we can assist in making it parallel. OpenMP, MPI and Hybrid models are all possibilities that any of our code assist team can discuss. We also have direct channels into HP/Compaq, IBM, SGI, Sun and a host of other hardware vendors.

If the code has the potential to cause system instabilities, we have the capability of moving it to a controlled testing lab. This facility, known as the Test and Development Environment (TADE), replicates our current machines on the production floor, but at a smaller scale. Here we are free to experiment and push codes to their breaking points in order to get them bug free. In this case it is the code assist team and the TADE, not Raid® or the Orkin® man, that kills bugs dead.

Computational Technology Center
There is a small army of scientists, engineers, and business professionals at the ASC MSRC devoted to making your computing experience with us as easy and painless as possible. The men and women of the ASC MSRC Customer Assistance and Technology Center are here to handle accounts, help desk, and applications support. At our facility most of this team is co-located to enable team-based strategies for problem solving and support.

The Application Managers have a combined total of over 100 years of experience with Computational Chemistry and Materials Science, Computational Structural Mechanics, Computational Fluid Dynamics, real-time systems, embedded systems, man-in-the-loop and Computer Science. Their responsibilities include software installation, trouble tickets, and user support. In most cases they were hired from industry due to their experience with the codes. This team can handle a large part of tier one and two questions with regard to applications.

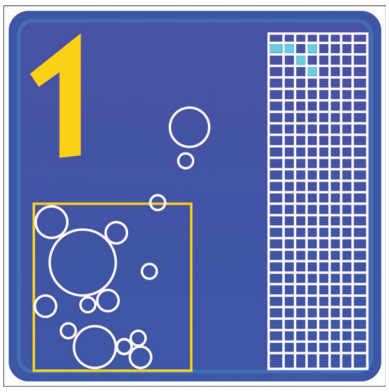
The Service Center and Accounts Center staff has a combined experience of 35 years of customer service and support. To make sure that the user experience of the ASC MSRC is as fulfilling as possible Service Center and Accounts Center staff makes it a business practice to ensure that communication and friendly service are daily occurrences. The Accounts Center handles all SecurID and user accounts functions and is available Monday - Friday 7:00 am to 5:00 pm EST. The Service Center is manned 24/7 and can be reached by calling 888-MSRCASC (677-2272).

LSF Plugin Scheduler

It never fails. Just when you have finally gotten all of the kinks out of your problem and written your job submittal script it seems like everyone in the world has managed to get into the queue ahead of you. You submit your job and diligently wait for it to start. You wait and wait and ARG! For all of you who have wondered what strange and twisted logic applies to queues, the ASC MSRC has good news. In cooperation with Platform Computing, Inc., the makers of LSF, we have developed a new and improved scheduler for use with our LSF enabled machines.

In the standard LSF scheduler a First-In-First-Fit (FIFF) methodology is used. Jobs are sorted by priority then by time. Jobs are then dispatched to queues starting from the top of the list. ASC found that in our environment there existed a possibility that jobs that requested a larger number of CPUs could be starved by small jobs of equal priority. To fix this we have designed an age-based calculation that incorporates wait time, number of CPUs, walltime and requested memory as weight factors. A job will now start to age and if at a certain age it has not started, the scheduler will reserve CPUs and backfill until the job's time to run. Jobs are now scheduled solely on age, thus evening the playing field. This scheduler is currently undergoing testing on our SGI 3900 (hpc11), with plans to be installed on our Compaq SC-45 complex if successful. So the next time you submit remember time (age) is on your side.

And the Number One Best Kept Secret of the ASC MSRC…..



Visual Queue

Visual Queue is a web-based application that allows users and administrators of high performance computing systems to monitor the life cycle of compute jobs from the time the jobs are submitted by a user, to the time they finish running and leave the system. There are many products that allow monitoring of job activity, but what makes Visual Queue unique is that it uses animation, sound and colors to visually show system activity "at a glance" in an intuitive display. Visual Queue provides both a "real-time" view of current system activity and the ability to "go back in time" to view past activity at high speed. You can quickly review the activity for an entire week in as little as 13 minutes.

So there you have it, the top ten best kept secrets of the ASC MSRC for 2004. We are already hard at work on next year's list. In fact, we may have to make it the top twenty list! We hope you now have a better understanding into the level of detail and the commitment to quality service that each and every person on our staff has to your continued success at our Center! If you have questions on any of these topics or if you would like more information, please contact us at 888-MSRCASC (888-677-2272) or *msrchelp@asc.hpc.mil*.

Point and Click HPC

By John Nehrbass, SIP on-site lead
Collaborators:
Marlon Pierce - Indiana University
Stan Ahalt - Ohio Supercomputer Center
Ashok Krishnamurthy– The Ohio State University
Juan Carlos Chaves – The Ohio State University
Siddharth Samsi – The Ohio State University

Many users find HPC systems difficult to use because of 1) the difficulty and misunderstanding associated with queuing systems for job submittal (Batch); 2) a lack of familiarity with command line access to Operating Systems (i.e. insufficient UNIX understanding); and 3) a difficulty in dealing with the inherent difference in the user-interfaces presented across HPC architectures, MSRCs, and Distributed Centers. In some cases graphical interfaces and scripts have been designed to assist a limited set of users for a limited set of applications. In most cases these interfaces are intended to reduce the user burden of submitting jobs. Unfortunately, these single point solutions are often rendered non-functioning by firewall and network issues and require special customized design. Thus, even when an ideal solution exists, the user must wait for infrastructure development.

This project is an attempt to significantly reduce the difficulty in using HPCs, address the issues that network security presents, minimize development time, and provide added services to the end user without prior knowledge. Since this is a significant challenge, the first instantiation is the delivery of a secure, browser-based access to a subset of the programs used by the signal and image processing and related communities in the DoD HPCMP. Next this technology will be extended to other Computational Technology Areas (CTAs) and HPCMP centers.

The portal architecture and security are addressed by having users log in over SSL and run “kinit” on the portal server. Once users obtain a ticket on the server, the ticket is managed by the portal account. The user can then run remote applications using rsh/ssh. If a user is able to access the Internet from a browser having 128-bit encryption, then firewall issues become moot. Access to the portal only requires a user to point their browser to an https:// URL. While this will not solve access issues for all users, it will be sufficient for most. Additional services that are planned include, but are not limited to: job submission, file management, job monitoring, and historical access to information allowing advanced organization of data and code version tracking.

A typical usage scenario proceeds as follows:

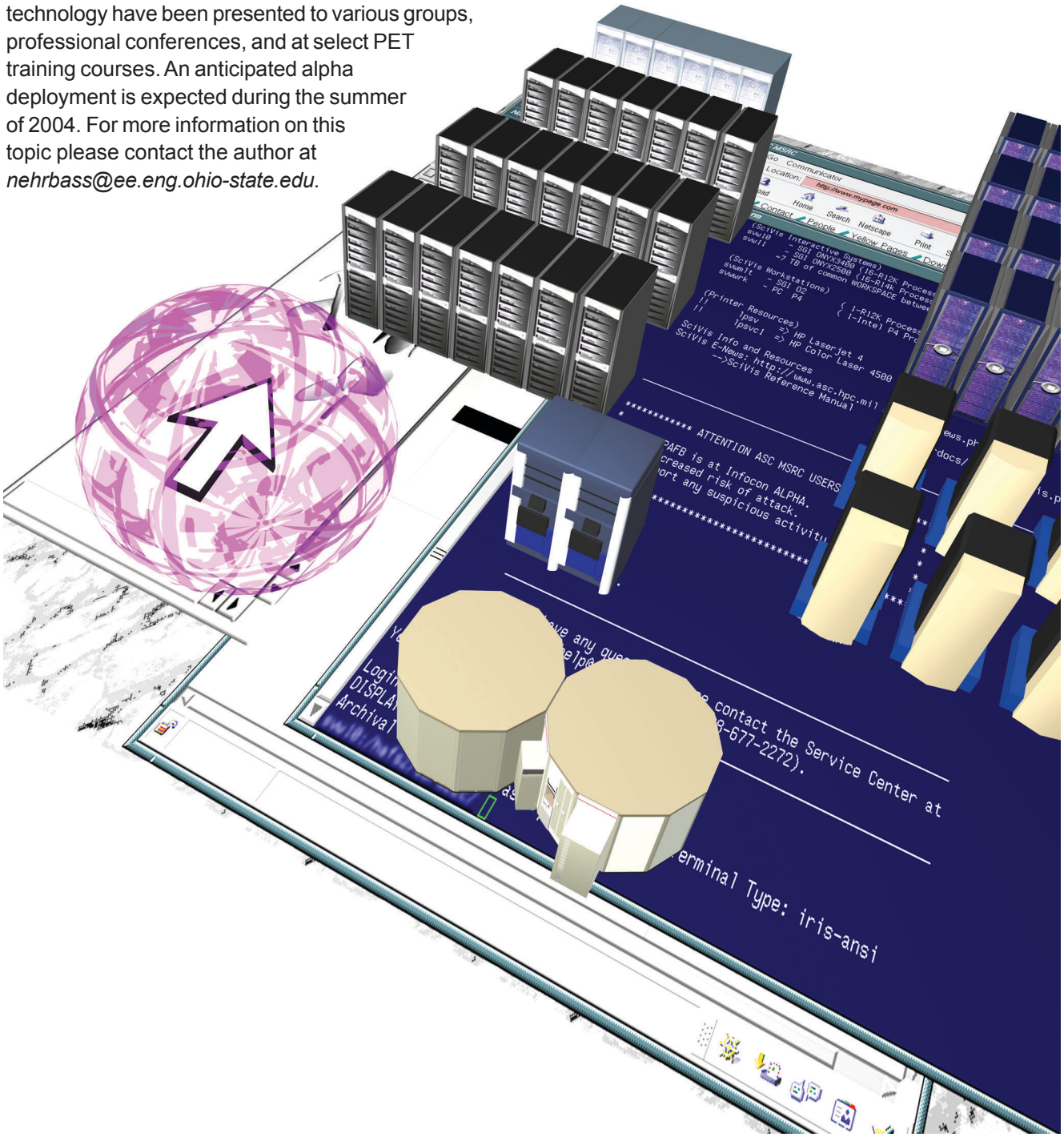
1. A user logs into the portal with secure access and is presented with information on particular machines that have preinstalled portal applications. They are able to launch any listed application, and are presented with browser based input setup pages through which the user can submit jobs to batch or interactive processing. These jobs can be monitored and the users can be notified when any job completes. Downloads of data and/or generated images through browser based graphical tools are realized by simple clicks of a mouse.

2. A novice user might desire to run a single processor code over a range of different input parameters. They use the portal as a guide for launching an embarrassingly parallel application. Automation codes assist the submission and organization of the data. The user is notified when the job is finished. For SIP, FMS, and CEA this is an extremely common task for XPATCH analysis.

3. A user wishes to run a code not previously installed and desires to add a user defined application to their list of portal applications. This can be done through a “GUI for GUIs”: a graphical user interface-building wizard. This wizard is limited in scope for the first prototype to any application that can be executed by passing it a set of input files and/or a set of input parameters. The portal user can provide a typical input file (Template) and the wizard will assist the user in identifying what parameters might be changed via the browser. Thus a customized interface is designed without knowledge of any computer or web language and requires no additional assistance from a third party. Furthermore, design is instantaneous. Once designed, the application is added to the users list of applications and may be used from this time forward.

4. The user may publish an application so that it is available to all other users. Therefore, only one member of a group need use the wizard for a common application, and all other members can access this application without delay.

This work is currently being installed and tested at select MSRCs. Small sets of users have been identified as use case testers. Several demos of this technology have been presented to various groups, professional conferences, and at select PET training courses. An anticipated alpha deployment is expected during the summer of 2004. For more information on this topic please contact the author at *nehrbass@ee.eng.ohio-state.edu.*



ASC MSRC Welcomes New CSM On-site Lead

By Brian Schafer, ASC/HPTT

The ASC MSRC is pleased to have Dr. Samir (Sam) Naboulsi as the new Programming Environment and Training (PET) on-site lead for Computational Structural Mechanics (CSM). He is employed by the University of Texas-Austin, supporting Dr. David Littlefield, the PET Functional Area Point of Contact (FAPOC) for CSM.

Dr. Naboulsi earned his Ph.D. in Applied Mechanics from The Ohio State University in 1995. His doctoral dissertation, *"Modeling the Manufacturing of Industrial Heterofilaments,"* focused on designing thin polymeric fibers where a numerical and analytical modeling of heterofilament liquid jet was performed.

Dr. Naboulsi comes to the ASC MSRC from the Air Force Institute of Technology (AFIT), where he was a Research Associate in the Department of Aeronautics and Astronautics. At AFIT, Sam advised and supervised graduate students (M.S. and Ph.D.) while performing research on material damage and structure survivability.

Sam is no stranger to the ASC MSRC. He has been an ASC MSRC customer since 1995, running codes such as ABAQUS, LS-DYNA, DYNA3D, CTH, ANSYS, NASTRAN on the SGI Origin 3900 and Compaq SC-45 systems, as well as using the SciVis laboratory for post-processing data.

Sam has over 14 years of experience in the CSM field. He has been involved in many DoD/Air Force related projects since 1995, performing survivability and life prediction analyses of structures and hydroram analyses for Man-Portable Air Defense System (MANPADS) investigations. Sam has developed special damage models to predict failures in composites under high strain rate and special fracture models to predict fretting fatigue life in turbine engine jet. He has also modeled advanced material behavior (e.g. plastic and visco-plastic behavior in composites) and implemented special constitutive models into both commercial and in-house computational structural codes (ABAQUS and DYNA3D).

As a PET CSM on-site, Dr. Naboulsi's activities are focused on improving existing DoD CSM computational tools, with an emphasis on developing and implementing more efficient algorithms for the HPC environment. Particular areas of application are advanced Finite Element Analysis methods, Adaptive Mesh Refinement methods for blast and penetration analysis, and Data Mining for large-scale simulations.

In his spare time, Sam enjoys quality time with his family, outdoor activities, reading, and biking. Dr. Naboulsi can be reached via email at *Samir.Naboulsi@wpafb.af.mil*.

A number of articles in this edition of the *Wright Cycles* reflect work performed in conjunction with PET on-site personnel hosted at the ASC MSRC.

PET on-site staff at the ASC MSRC includes:

- Dr. Philip Amburn (FMS)
- Dr. Jean Blaudeau (CCM)
- Dr. Sam Naboulsi (CSM)
- Dr. John Nehrbass (SIP)
- Dr. Paul Sotirelis (CEN)
- Dr. Hugh Thornburg (CFD)
- Dr. Rhonda Vickery (ET)
- Dr. Steven Wong (CEA)

If you are interested in additional information on current and past activities within the PET Program, please visit the PET Online Knowledge Center (OKC) (*https://okc.erdc.hpc.mil*). The PET OKC is a repository of PET programmatic information and technical knowledge in computational science and in the ten computational technology areas. The OKC provides access to software tools and products, current information on PET projects, information on past training courses, and the opportunity to register for upcoming training courses.

FMS Colloquium

By Phil Amburn, FMS on-site lead

The first Forces Modeling and Simulation (FMS) Colloquium in HPC was held March 4-5, 2004 at the Science Applications International Corporation (SAIC) offices located in Orlando, Florida. Among the approximately 20 people attending the meeting were representatives from all three services, the Joint Forces Command (JFCOM), and a representative of the HPCMPO.

The opening sessions provided an overview of the PET Program and the FMS computational technology area. There were several presentations highlighting ongoing and planned DoD programs that require HPC resources. Various aspects of FMS related programs, including specifics on how JFCOM was able to include one million civilian elements in a simulation using the joint semi-autonomous forces (JSAF) model were also presented. A consistent theme throughout the presentations was the utility of Linux clusters. Many of the existing FMS models and simulations currently run under the Linux operating system, and a Linux cluster is an effective option for utilizing HPC resources.

For information about FMS capabilities at the ASC MSRC, or FMS in general, contact Phil Amburn at *Philip.Amburn@wpafb.af.mil*.

Emerging Trends

By Rhonda Vickery, ET on-site lead

Welcome to the first edition of "Emerging Trends," a PET Enabling Technologies (ET) column where you will find information on the status of current initiatives, as well as upcoming prospects that will benefit our users.

In this segment I will discuss remote visualization in terms of what it is, why it is difficult, and what we are doing to improve this service. The process required for a scientist to see a visualization on the desktop is outlined in the figure on the next page. The model or data is often generated by HPC simulations, and with large datasets, it is desirable to keep this data on the remote HPC server and send some smaller amount of data to the desktop. In using a visualization application, the scientist determines what parts of the data should be drawn on the display (termed extracts), and the application creates a 3D scene. This scene is then projected to 2D and rendered to pixels for the desktop display. The capabilities of the data server, desktop system, and network, determine where each stage of the process is done to effectively deliver a useful picture to the scientist. This requires the correct balance of computation and communications between the remote data facility and the desktop. The process is further complicated by network security and Kerberos requirements.

Most people who have tried UNIX-based remote visualization are familiar with the concept of setting the X-display back to the desktop. The remote server does the extractions, scene creation, and projection to 2D, as shown in the figure. The X-protocol commands are then sent across the network to the desktop running an X-window server, which renders the pixels. Although the graphics capabilities of the desktop are used, this process is not efficient on low bandwidth networks, and this option is often not acceptable for everyday use of graphics applications.

Another approach employed by many client-server applications is to create an optimized client application that runs on the desktop and accepts commands and information from the remote server. For a product such as EnSight, this option takes advantage of the graphics capabilities of the desktop system to do the projection to 2D and rendering to pixels. The remote server creates the visualization extracts and the scene, which is then sent over the network to

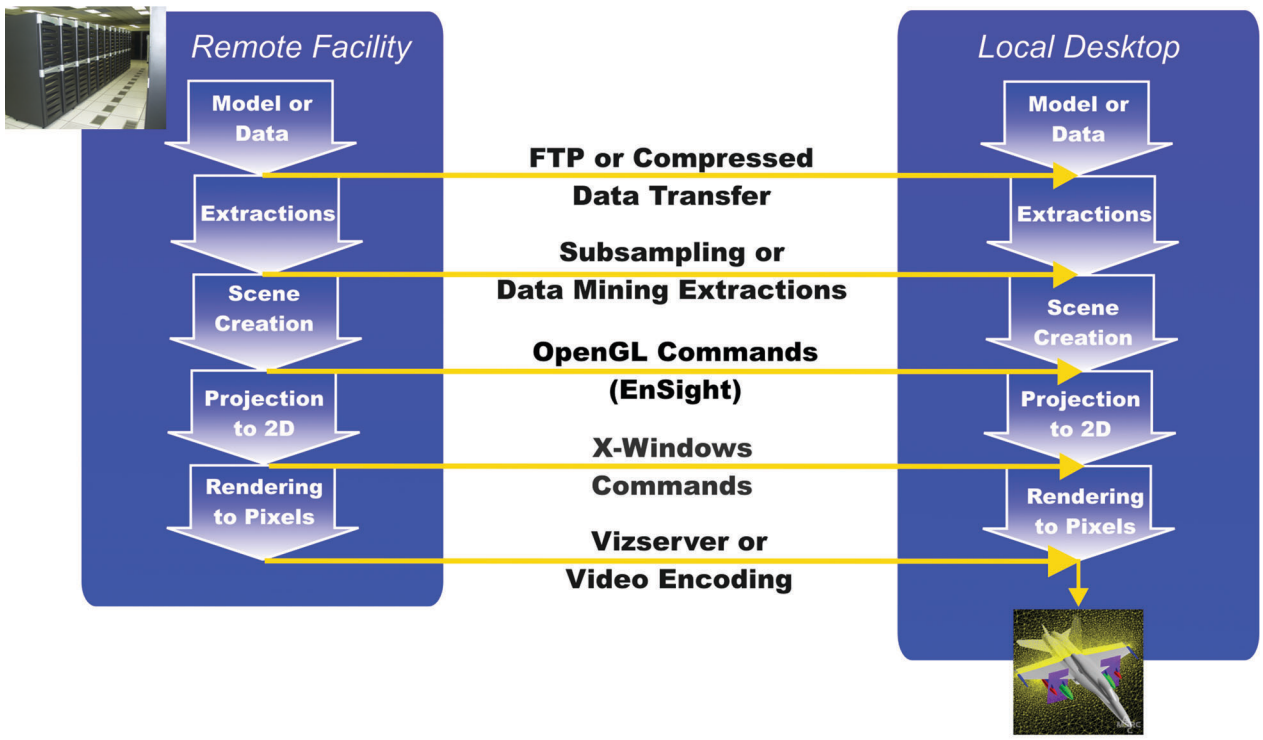
the workstation in the form of OpenGL commands. How well this works depends on the network bandwidth and the efficiency of the application. These products can usually be run without additional intervention by systems administrators.

For situations where the capabilities of the desktop system has minimal graphics capabilities, there are applications that do all of the work on the server and only transmit compressed pixels over the network. Examples of this type of application are SGI's Vizserver and a video over network product called Teraburst. These products have the potential to work well in lower bandwidth conditions, but also require special hardware and configuration by systems administrators. The main advantage of this approach is that it will work with any application, so the scientist is not required to learn a new visualization product to do analysis.

At ASC we have initially been investigating the use of two products for remote visualization: EnSight and Vizserver. Visualization experts at ARL have had excellent success running EnSight in client-server mode with the server running on SciVis systems at ARL, and the client running on SGI or PC systems from places as far away as Penn State University and Redstone Arsenal in Huntsville, Alabama. They also routinely use EnSight from home with acceptable speed. We are currently not getting that kind of performance from locations around WPAFB to the ASC MSRC, and are investigating the problems so they can be fixed. Vizserver has been proven to work in specific instances, but new releases are difficult to integrate with Kerberos. Testing between SGI systems is underway, as well as planning for testing using Windows and Linux systems. The latest version of Vizserver will soon be tested in the TADE. Several local groups are interested in testing both EnSight and Vizserver, once these problems are resolved.

Other products that will be evaluated for remote visualization potential are Presto, ParaView, and Fieldview. Web-based visualization technologies are also under development, and will eventually be available for use with running HPC jobs. If you are interested in keeping abreast of the latest developments in this area, contact Rhonda.Vickery@wpafb.af.mil to be added to the list for email updates.

Acknowledgment: Robert Moorhead of Mississippi State University and personnel from the DoD MSRC Visualization Labs are gratefully acknowledged for their significant contributions.



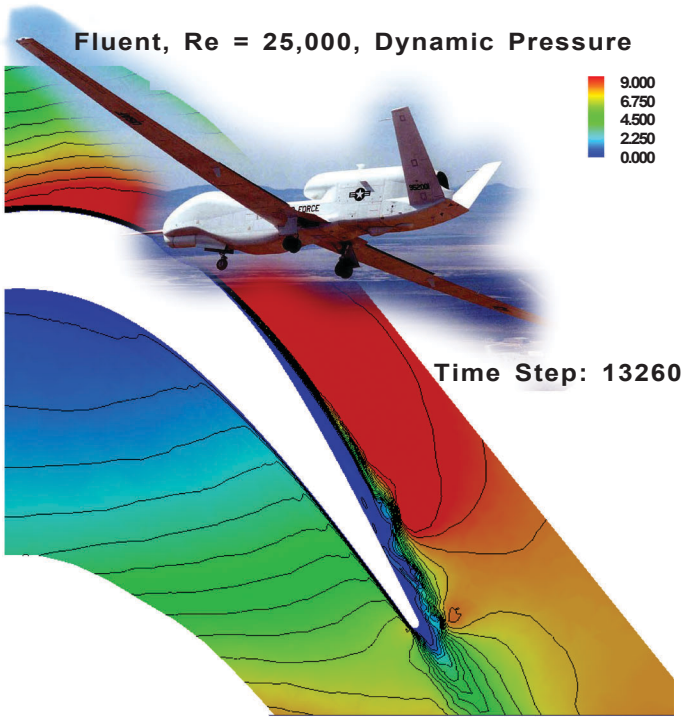
The process required for a user to see a visualization on their desktop.

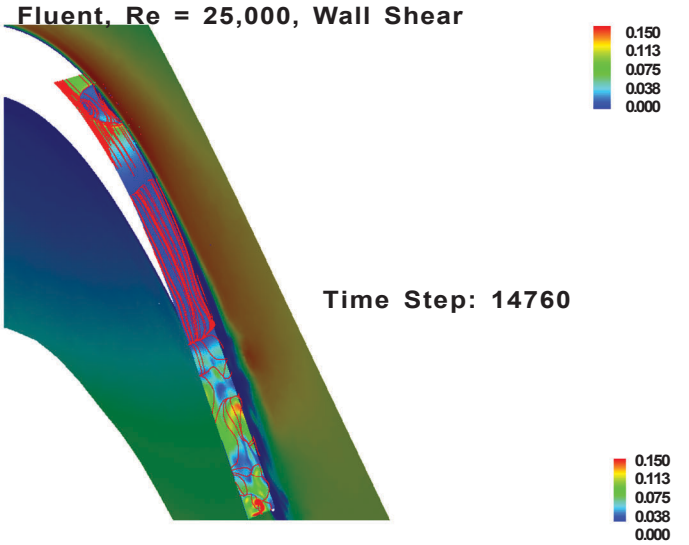
ASC MSRC Resources Used to Design Dimpled Turbine Blades

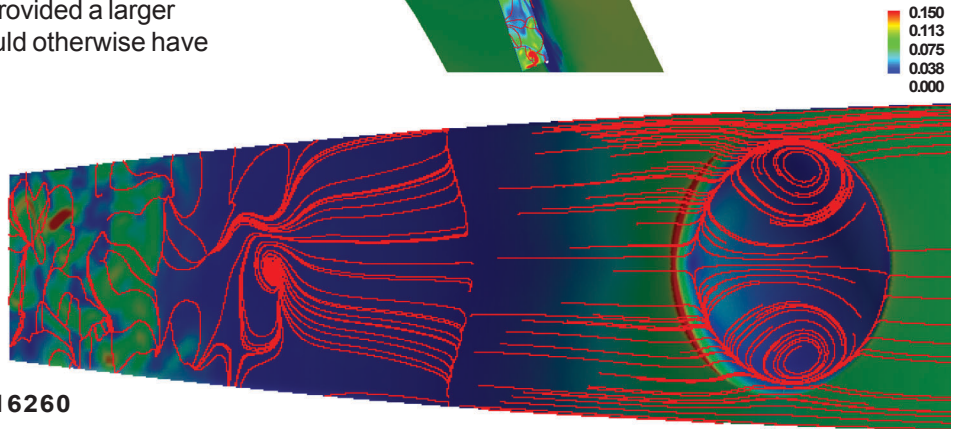
By Hugh Thornburg, CFD on-site lead

Unmanned Aerial Vehicles (UAVs) are employed for high altitude reconnaissance. The range and endurance of UAVs, such as the RQ-4 Global Hawk, is limited by the low-pressure turbine (LPT) efficiency. Low Reynolds numbers experienced by LPT blades cause losses in efficiency and loading. The problem is seen in the Global Hawk Program where the on design flight conditions are a standard cruise velocity of Mach 0.6 at an altitude of 65,000 feet.Thus the LPT blade operates at an axial cord Reynolds number below 25k, with laminar boundary layers and flow separation. Losses due to separation place restrictions on the range, altitude, and electrical power extracted from the engine. The loss mechanism is similar to that of a bluff body, such as a golf ball, traveling through the air. Golf balls have long employed dimples on the outer surface in order to lessen the separation bubble size and resulting losses. Lt John Casey, then a graduate student at the Air Force Institute of Technology (AFIT), undertook a study of using dimples for the control of flow separation around a low pressure turbine blade at low Reynolds number. This was in conjunction with Professor Paul King, AFIT/ENY, and Rolf Sondergaard of AFRL/PR.

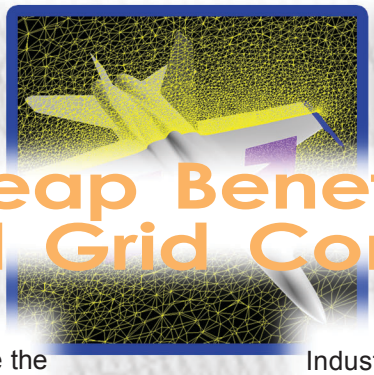
An integrated experimental and computational study was performed in order to study the effect of dimple placement and geometry on separation control. The commercial package GridGen was used for the development of the discrete models, while Fluent was used for the flow simulation. The size of the model required for accurate spatial and temporal resolution required much CPU time and resulted in vast quantities of data to be analyzed. Fieldview was used to analyze the simulation data and extract useful engineering information. The ASC MSRC's software and hardware resources supplemented AFIT's and provided a larger quantity of higher fidelity data than could otherwise have been obtained.





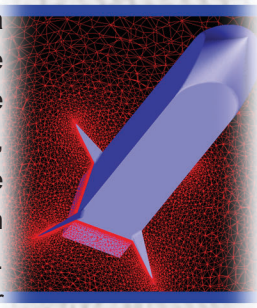


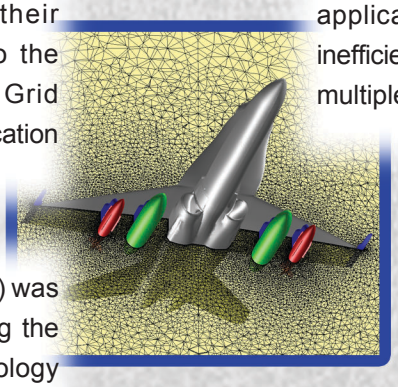
CFD Users Reap Benefits of Unstructured Grid Consortium

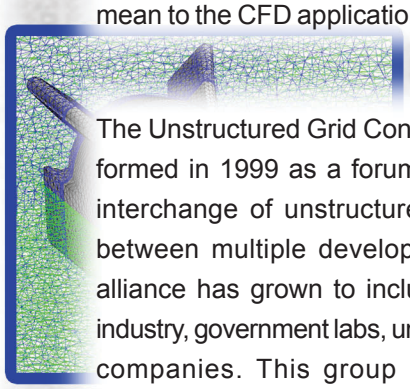


By Todd Michal, Boeing Phantom Works

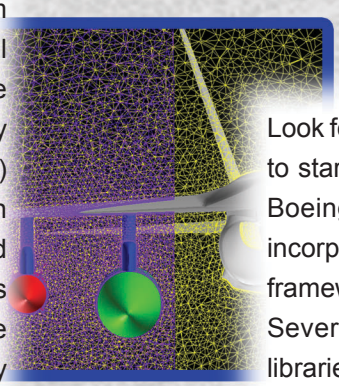
Have you ever wished you could combine the capabilities of multiple Computational Fluid Dynamics (CFD) grid generation tools into a single product? Soon this scenario will become much easier and may become available in the tools you are currently using. In the fall of 2004, the Unstructured Grid Consortium will release version 2.0 of a specification for interfacing mesh generation software modules and applications. This specification will make it much easier for software developers to plug and unplug conforming software modules into their applications with little or no rework to the software. What is the Unstructured Grid Consortium, and what will this new specification mean to the CFD applications engineer?

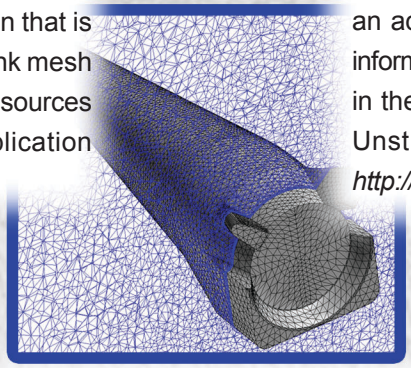




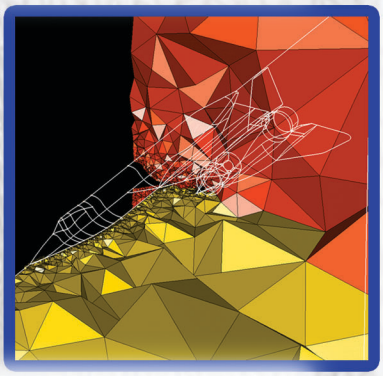


The Unstructured Grid Consortium (UGC) was formed in 1999 as a forum for facilitating the interchange of unstructured grid technology between multiple development efforts. This alliance has grown to include members from industry, government labs, universities, and small companies. This group is advocating the development and implementation of an industry standard Application Program Interface (API) to govern the interaction between mesh generation software modules or libraries and mesh generation applications. Version 1.0 of this specification was completed under Air Force funding in 2002. A second version is currently under development by an industry-wide team and scheduled to be completed in the fall of 2004. A mesh generation software application that is compliant with this API will be able to link mesh generation capabilities from a variety of sources with little or no changes in the application software.





Industry-wide adoption of the UGC API will expand the selection of mesh generation technology available to CFD users and accelerate the transition into production use. Tools that are compliant with the API will have access to a much wider range of algorithms and approaches than currently are available. This selection will allow users to mix and match components from a variety of sources to develop the best process for the problem at hand. All of this will be achievable within a single mesh generation application eliminating the annoyance and inefficiencies associated with switching between multiple user interfaces.



Look for applications incorporating the new API to start showing up in users hands next year. Boeing and NASA Langley are planning to incorporate the new API into mesh generation frameworks later this year and early next year. Several publicly available mesh generation libraries may be modified within the first year. Eventually commercial vendors may modify their products to be compliant with the API providing an additional source of capabilities. For more information and to keep abreast of the latest news in the API development effort, please visit the Unstructured Grid Consortium web site at *http://www.pointwise.com/ugc*.

Software Management

By Maria Zimmer, ASC/HPTA

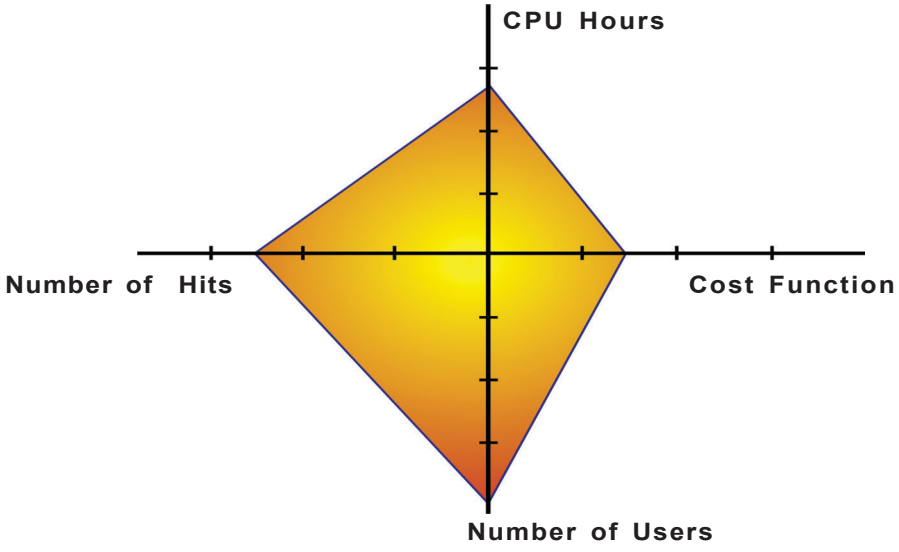
One of the many value added benefits provided by the ASC MSRC is access to the large selection of software packages available in our environment. We offer a robust list of 166 different software packages that run on one or more of our HPC platforms and/or on our Scientific Visualization (SciVis) platforms. These packages represent 225 instances of codes in the following categories: Programming (60), Analysis (56), SciVis (59) and Utility (50).

Our Application Managers offer expert advice on the use of these packages, assisting the users in coding of scripts, and data development and job execution. What most people do not realize is the tremendous effort needed to efficiently manage this large suite of software packages.

Software management at the ASC involves the direct efforts of nine contractors and three government personnel. The responsibilities of managing this software suite involves establishing procedures to be followed when acquiring or removing software; identifying metrics to be used for monitoring software; acting as POC for acquisition of new packages; acting as POC for the updating of restricted software; providing oversight to ensure all software restrictions and license agreements are enforced; managing the software baseline, and; tracking costs of the various commercial off-the-shelf (COTS) packages. Approximately 180 man-hours a week are spent on the management of these packages.

One of the major challenges to this team is the task of acquiring or renewing codes. This decision is not as simple as just looking at the values such as the number of hours used or the cost. An in-house tool, Graphite, was developed to aid the Software Management Team in trend analysis. Graphite collects data on cost, number of license hits, number of users, and CPU hours, and charts software utility.

These “diamond charts” are then ranked by areas against their peers. Trending out in any direction is “good.” For instance, higher numbers of hours or license hits is desirable, while trending out on the cost axis is actually lowering the amount of funds that we spend. (Cost is a function that is defined as the normalized inverse of actual cost). This tool helps to focus attention to lightly used or abandoned codes thus providing data for decisions based on proven business practices such as return on investment (ROI).



The ASC MSRC has a tradition of providing an abundant amount of software packages to the HPCMP community. We look forward to continuing this service and by following this fair, unbiased approach we remain good stewards of the taxpayers’ money.

Expanding Customer Assistance to 24x7

By Daniel Schornak, CSC

The ASC MSRC continues to improve processes and methods of providing timely and accurate support based upon user needs. From project and user account processing, to user requests for support, the Customer Assistance and Technology Center and the Operations staffs stand ready to support these needs.

In order to utilize staff more efficiently and effectively, over several months the Accounts Center and the Service Center staffs have been cross training. Staffs have learned the tools and processes necessary to perform each other's tasks. This has now given the ASC MSRC the capability to temporarily realign these personnel to support periods of heavy workload that may occur in each Center's area. The benefit to the user is improved response time within these critical support areas.

Problems and issues do not wait for normal business hours. Since the ASC MSRC user base spans several time zones, it is understandable that situations will arise during non-business hours that need to be addressed. As the ASC MSRC Operations team is available on a 24x7 basis, their role has been expanded to include creating service tickets for users requiring assistance outside of the normal business hours.

Due to their "mission essential" status, the Operations team must report to work under all adverse conditions, including emergency base closures. This presence permits the team to be available to receive and process user inquiries and create service tickets. Also, due to their close proximity and knowledge of scheduled and unscheduled maintenance of systems within the HPC environment, the Operations staff can provide inquiring users HPC environment-related status information.

Monitoring of the HPC computer systems and facilities environment is performed continuously through the use of system scripts and two utilities, SiteScan and Nagios®. SiteScan is a monitoring solution for critical environments that utilizes a facility-view approach. The system enables communications from Liebert environmental and power units, as well as many other pieces of analog or digital equipment, to a front end software package that provides monitoring, control, and alarm management. Nagios® runs intermittent checks on specified hosts and services using external "plug-ins" which returns status information to Nagios®. Current status information, historical logs, and reports can all be accessed via a web browser.

Another resource available to the user is the ability to start the service ticket creation process without the necessity of telephoning for customer assistance. The ASC MSRC provides an online service that will notify the Customer Assistance and Technology Center. Notifications are serviced during normal ASC MSRC business hours. The URL for this resource is *http://www.asc.hpc.mil/cust_serv_form.php.*

The ASC MSRC continues its efforts to exceed user support needs and requirements. Please contact the ASC MSRC Customer Assistance and Technology Center via email at *msrchelp@asc.hpc.mil* or 1-888-677-2272 with any suggestions for improving our services. We stand ready to serve.

SMART Changes Make for Smarter HPC Users

By Chanon Owen and Orville Walters, CSC

The ASC MSRC recently enhanced their System Management And Reporting Tool (SMART) to provide expanded service request capabilities and improved utilization reporting, to better serve the Center's HPC users.

The first enhancement benefits the ASC MSRC's users by reducing response times to service requests. The Service Request Subsystem (SRS) has a new "SRS Lite" tool available to tier two and tier three support staff. This tool places all service request information at the fingertips of the technicians. Upper level support staff members no longer have to go through the Service Center to get service request information, review history of request activities, or send an email to a user. This "eliminates the middle man" in a sense, and results in resolving our users' issues in a more efficient manner.

Our tier two support staff now has the ability to review any previous service request a user has submitted. Also, our staff has the ability to view detailed information on a user, such as project information, other users on a particular project, allocation, and account history. All of this information is now readily viewable by using SRS Lite. This new application ensures our tier two support staff has all the information needed to assist the users.

The second enhancement provides the ASC MSRC Service Center greater access to utilization information. The "Utilization Data" form allows the Service Center to review and filter utilization data, export HPC usage data in an Excel-friendly format, and credit HPC usage when needed. So if you are an HPC user and you would like to see your usage, the ASC MSRC Service Center can easily export this data and send it to you.

The Service Center is able to view any job that has run on any ASC MSRC system in the past two years in a matter of minutes. Built-in filters allow our personnel to sort through thousands of records while the user remains on the phone. If one of our users has a discrepancy or would like to know how long a particular job ran, our Service Center personnel can provide that information in a timely manner.

Users who are interested in job information should contact the ASC MSRC Service Center at 1-888-677-2272, or via email at *msrchelp@asc.hpc.mil.*

Utilization by the Air Force Challenge projects is ahead of the curve! At the end of March 2004, the mid-point of the Fiscal Year, these Challenge projects had already burned 70% of their allocations!

The ASC MSRC, along with Major Ed Williams, HPC Program Manager, Air Force Office of Scientific Research and Ms. Bobbi Ruf, Assistant HPC Program Manager, has worked diligently with Air Force users to help them understand the benefits of using high performance computing in their efforts supporting the warfighter. Recently, ASC MSRC team members offered assistance to our users in preparation of DoD FY05 Challenge proposals. This assistance included proofreading, ensuring HPCMP defined formatting was utilized, and offering recommendations regarding the appropriate resources and number of CPU hours.

Helping users understand and more efficiently use the resources and services of the HPCMP is paramount in the mind of ASC MSRC personnel and will continue to be the foundation by which we operate.

Joint Strike Fighter Success Story

By Roger Panton, The Greentree Group

"Over the span of a week we were able to run all of the ATLAS CDR (Critical Design Review) analysis (including script debugging, rerunning, and Matlab post-processing) using 15,000 hours of CPU time. This would have taken over 2 months to run on our ten batch machines. We never would have been able to meet our December 18, 2003 goal of turning over CDR data to JPO (Joint Program Office) without this computing resource."

Kenneth Armstrong,
Joint Strike Fighter (JSF) Flight Control Systems Deputy, Lockheed Martin (LM)

In the fall of 2001 Edward "Pete" Aldridge, DoD, Under Secretary for Acquisition, Technology, and Logistics directed LM's JSF Program to find ways to reduce the cost of testing using modeling and simulation (M&S). Paul Metz, Director JSF Test and Evaluation (T&E), LM took on an initiative to identify potential ways of reducing or savings cost using M&S. Mr. Metz began by taking a fact-finding tour of Navy and Air Force organizations in February 2002 to solicit ideas and identify possible candidates to achieve Mr. Aldridge's objective. One of Mr. Metz's stops was at Wright-Patterson Air Force Base where he met with and received briefings from several different organizations. ASC MSRC requested time to brief Mr. Metz. Herbert "Skip" Hickey presented an informational briefing about the ASC MSRC and the DoD HPCMP. Mr. Metz agreed that making use of these DoD resources to augment HPC resources at LM could potentially help reduce the testing cost and schedule for the JSF Program.

Mr. Hickey followed up the briefing to Mr. Metz by contacting and working with different points of contact in the JSF JPO and LM. After providing these individuals with information and the capabilities that the HPCMP could bring to the table, Mr. Hickey worked with his contacts to answer questions and provide detailed information on how to get accounts, resolved security questions, and connectivity questions. Danny Rape and Jim Manley, of LM, began to define HPC requirements within the JSF program and coordinated these with Capt A. Baldoza, of the JSF Program Office.

Continuing dialogue through e-mails and teleconferences between LM and the ASC MSRC resulted in a final review meeting at WPAFB. This meeting was held to review requirements and make a final decision about the use of DoD HPCMP resources. In July of 2003 ASC MSRC hosted a meeting with representatives from the JSF Program Office, LM, and Northrop Grumman. Mr. Steve Wourms, ASC MSRC Director, presented an overview of the HPCMP. An in-depth briefing was given on the Defense Research & Engineering Network (DREN) and connectivity, user assistance, classified HPC capability, and the PET Program. The conclusion of the meeting was that LM believed that making use of the DoD's HPC capability, as an augmentation to their own HPC resources, would benefit their efforts to reduce cost of T&E for the JSF program.

This is just one of many success stories that is helping the DoD HPCMP provide resources in the DoD transformation to a new warfighting approach. Other programs that have made use of the HPC resources at ASC include the Airborne Laser, Predator, Panoramic Night Vision Goggles Sled Ejection Tests, and X-45C Unmanned Combat Air Vehicle to name a few. All of these programs have been very pleased with the support and capabilities provided and have plans to continue use of the HPC resources on an as needed basis in the future.

Unsung Heroes at the ASC MSRC

By Steve Wourms, ASC MSRC Director

Now that's a frequently used catch-phrase. And although Google® will give you hundreds of thousands of hits, I figure the term is entirely appropriate for my use; I'm not aware of anything catchier or more appropriate.

Just to be clear, I'm using the term to refer to someone who is admired for their achievements or qualities - a "hero." Furthermore, that person is not celebrated or praised, and thus the "unsung" modifier.

I'd like to bring some unsung heroes out of the closet. These aren't the pretty faces you've come to appreciate or even enjoy from ASC, such as Jeff Graham, Maria Zimmer, Ralph McEldowney, Donna Klecka, or Bill Asbury. Although each and every face deserves their own section of this article, I must refrain from mentioning any by name, as I don't have enough space to work with on this page.

We like to stress that we're a full service high performance computing operation and not just a computer center. If you stop to think about what that means, you should catch on that it takes a lot of people with a lot of different sorts of expertise to make the machines do more than hum and keep their lights blinking. I'll start with those who make the humming and blinking happen—those are the **Operations** folks, a bunch that includes a lot of unsung heroes! These are the operators, system administrators, and facility experts who are using increasingly sophisticated tools to make our world-class systems work effectively and efficiently.

Another noteworthy bunch is the **Customer Service** staff. They are often your first point of contact when you call our Center. They perch at the Help Desk and in the Accounts Center. Some manage the myriad software applications here. They are not to be confused with the **Customer Outreach** function; these folks worry about our outside image for conferences, tours, written materials, and other forums.

Where would we be without all the individuals who can land themselves, or even us, in jail? For starters, there are those who worry about our **Financial** and **Contracting** activities. The scales and complexities of running a successful high performance computing center involves large sums of money moving through a number of contract vehicles. They use esoteric terms like "appropriations," "color-of-money," and "expenditures." Then there's the **Security** team, which keeps us straight on DoD and Air Force policies in physical, personnel, information, software, networking, and other realms. Finally, our good friends in **Human Resources**, who struggle mightily to keep us in-line as we work personnel efforts.

There is no end to the types and number of **Special Projects** that we're working. Some of these are handed down from the Program Office. Some come from our own local Aeronautical Systems Center. But most of our special projects are internally generated. These folks include but are not limited to our fantastic staff of **PET** on-sites. Do you ever worry about these special projects folks and their sanity?

I'm incredibly proud and honored to serve with all the folks mentioned herein. They truly are the lifeblood of our Center; we could scarcely function without them.

These unsung heroes are rather reclusive, and while they remain nameless, I hope you'll recognize their functions and their importance. Although you might catch a glimpse of them at HPCMP functions such as the Users Group Conference, they tend to shun the limelight. Should you wish to observe these folks in their natural habitat, you're most likely to find them behind partition walls in Building 676, Area B, at Wright-Patterson Air Force Base in Dayton, Ohio. But please don't feed them….

SC03

By Maria Zimmer, ASC/HPTA

ASC MSRC personnel were very active at Supercomputing 2003 (SC03) held in Phoenix, Arizona November 15-21, 2003.

Jeff Graham, ASC MSRC Deputy Director, was one of the distinguished participants on the panel "Next Generation Computing: The Impact on Diverse Communities" chaired by John Hurley of Boeing. Jeff was also an active SC03 committee member, assisting with the setup and organization of the Research Exhibits.

Ralph McEldowney, Government Advanced Technologies Branch Chief, and CSC's Systems Integrator/Network Specialist Tracey Wilson, were members of the SCinet 2003 committee that installed and operated the data network for over 7000 conference participants. In addition to a central Network Operations Center (NOC) constructed in the middle of the Phoenix Convention Center, SCinet also constructed five Distributed NOCs (DNOCs) around the convention center floor.

Ralph captained the DNOC team that won the SCinet award for "Best DNOC." This award was based on the overall appearance of the DNOC including fiber optic cables, power cables, and general neatness.

Government Applications Management Branch Chief Maria Zimmer and Hank Laughlin, CSC's Outreach Coordinator, demonstrated the ASC MSRC's Visual Queue at the HPCMPO booth. Developed by in-house ASC staff, Visual Queue uses animation, sound, and colors to visually show system activity in an intuitive display. *(See "#1 Best Kept Secret of the ASC MSRC" page 5.)*

Other ASC MSRC team members in attendance were Steve Wourms, ASC MSRC Director; Brian Schafer, Government PET Component 2 Technical Advisor; Carl Radeloff, Government Systems Administrator; Jacqulyne Person, Government Administrative Support; Donna Klecka, CSC Program Manager; Bill Asbury, CSC Deputy Program Manager; Larry Haas, CSC Systems Administration and Networks Manager; Don Cable, CSC System Administrator; Vaughn Noga, CSC New Technologies Manager; Nick Pellegrini, CSC New Technologies; and Chuck Abruzzino, CSC Outreach.

All attendees actively participated in the sharing of new ideas and new innovations in the HPC/Network arenas and look forward to SC04 to be held in Pittsburgh, Pennsylvania November 7-12, 2004.

SPO Directors Visit

As part of the first quarterly Focus Week planned by the new ASC Commander, Lieutenant General William R. Looney III, the ASC MSRC was pleased to host a visit from a majority of the two letter chiefs in ASC. Over thirty of ASC's top staff received an overview briefing, as well as tours, of both the Simulation and Analysis Facility (SIMAF) and the MSRC - the two primary capabilities in the Advanced Computational Analysis Directorate (ASC/HP). An overview of the key facets of the DoD's HPC Modernization Program kicked off a walking tour of the facility, culminating in a review of some of the great work being accomplished at the ASC MSRC. Some of the work highlighted was described by Hugh Thornburg, including some critical Predator work and an overview of work being done to design dimpled turbine blades to reduce engine wear. *(See related article page 11.)* The energetic visitors left with a positive impression of the capabilities available at the ASC MSRC.

ASC MSRC Visitors

ASC Commander Lt Gen Looney

Dan Risha (left) and Alan Garscadden (center), Chief Scientist, AFRL Propulsion Laboratory

Ricky Peters, Technical Director, AFMC/EN

Kevin Cook, Senior Staffer, Energy and Water Subcommittee

University of Nebraska ROTC

The Miami Valley School Technology Immersion class

Les McFawn, Executive Director, AFRL

Sam Greenwood (center), Chairman of the Board, The Greentree Group; Wayne Struble (right), Chief-of-Staff for Congressman Hobson

Upcoming Conferences

June 7 - 11, 2004
DoD Users Group Conference
Williamsburg Marriott
Williamsburg, Virginia

June 29 - 30, 2004
High Productivity Computing
Systems Program and Productivity Summit
Hyatt Fair Lakes
Fairfax, Virginia

July 27 - 29, 2004
Commodity Clusters for Large-Scale Scientific
Applications (ARL/OSC)
Holiday Inn
Tysons Corner, Virginia

August 8 - 12, 2004
SIGGRAPH 2004
Los Angeles Convention Center
Los Angeles, California

September 10 - 15, 2004
Visualization 2004
Hyatt Regency Austin
Austin, Texas

September 20 - 22, 2004
HPC User Forum
Loews Ventana Canyon Resort
Tucson, Arizona

September 27 - 30, 2004
High Performance Embedded Computing Workshop
MIT Lincoln Laboratory
Lexington, Massachusetts

November 6 - 12, 2004
Supercomputing Conference 2004
David L. Lawrence Convention Center
Pittsburgh, Pennsylvania

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